REMARKS

The present application includes claims 1-22. By this Amendment, claims 1 and 11 have been amended as set forth above. The Applicants respectfully submit that pending claims 1-22 define patentable subject matter.

Claims 1-20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 5,622,174 ("Yamazaki") in view of United States Patent No. 6,017,309 ("Washburn"). Claims 21 and 22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki in view of Washburn and United States Patent No. 5,718,229 ("Pesque"). The Applicants respectfully traverse these rejections for at least the following reasons:

I. Claims 1-20 Are Not Rendered Unpatentable Over Yamazaki In View Of Washburn

The Applicants first turn to the rejection of claims 1-20 as being rendered unpatentable over Yamazaki in view of Washburn.

A. Yamazaki Does Not Describe, Teach, Or Suggest An Adaptive Coloring System

Yamazaki discloses an "ultrasonic diagnosis apparatus" that includes "an element for calculating movement velocities every sampling volume on the basis of the ultrasonic echo signals," and an "element for displaying in color the movement velocities." *See* Yamazaki at Abstract. Yamazaki, however, describes a non-adaptive system and method displaying movement velocities in color.

For example, Yamazaki discloses an embodiment in which velocity changes are shown through variable shading of one or two colors:

> For the category (i), there are two ways: (i-a) one way uses the same color, but brightness changes according to the magnitude of velocity, (i-b) the other way uses changed colors according to the magnitude.
>
> For the category (ii) of display, the direction is displayed by changed colors and the magnitude by changed brightness. With respect to display of the direction, applicable display ways are restricted according to conditions of velocities calculated. **The color processing circuit 24b of this embodiment will determine color as shown in FIG. 7.** That is, while the contraction of a cardiac muscle is colored as red and the expansion as blue, increased velocities are assigned to brighter red or blue (i.e. increased brightness). In conventionally used color Doppler image, a blood flow going toward the ultrasonic beams is displayed as red and a blood flow going away from the beams as blue.

Id. at column 11, lines 17-32 (emphasis added). That is, Yamazaki describes a fixed mapping of color hues.

Notably, Yamazaki discloses a system and method in which movement of the cardiac muscle is shown **only** in red or blue, with increased velocities "assigned to brighter red or blue." Further, "contraction of a cardiac muscle is colored as red and the expansion as blue." *See also id.* at column 27, lines 23-27 ("This embodiment is such that the curves in systole periods represent changes in area of red or red-related color within the ROI; those in diastole periods represent changes in area of blue or blue-related color within the ROI."). Thus, in Yamazaki, velocity calculations are assigned colors, **but are not used to determine color representations for those velocities**. Yamazaki clearly articulates this notion of fixedly assigning red or blue to particular velocities at column 37, lines 9-12:

> In the color processing circuit 24b, for example, red or re-related color is given to positive contraction velocity

> (contraction) and blue or blue-related color to negative contraction velocity (expansion), and brightness is changed according to its magnitude.

Yamazaki assigns only red to a particular type of velocity (e.g., positive contraction velocity), and only blue to another velocity (e.g., negative contraction velocity), and merely varies brightness of those two colors to denote increased velocities. The color scheme is fixed in that contraction is colored as red and expansion as blue, with increased velocities denoted by varying brightness. *See id., e.g.,* at column 11, lines 59-64 ("The cross-sectional image consists of a B-mode tomographic image (black-white gradation) of a heart and a color velocity image (2-D) of the cardiac muscle of the heart colored, **which is determined according to a color table shown in FIG. 7**...."), *and* column 29, lines 51-56 ("The stored data in the unit 150 will then be sent to the DSC 156 having a DSC circuit 151 for converting scan systems and a color processing circuit 152 having a **lookup table to color velocity data**. As a result, the converted and colored velocity data are outputted from the DSC 156 to the image data synthesizer."). As shown in Figure 7 of Yamazaki, the color table clearly shows that contraction is always assigned red, while expansion is always assigned blue. There are no other possibilities. Nor does Yamazaki generate the color characteristic signals based on the detected velocities. Instead, as shown in Figure 7, the colors are pre-assigned based on contraction or expansion.

Yamazaki, however, does not "generate... a mapping algorithm to generate a set of color characteristic signals representative of said values of said movement parameter," as recited in claim 1, nor "generating a set of color characteristic signals representative of said values of said movement parameter in response to a distribution of said set of

parameter signals and a mapping algorithm," as recited in claim 11. Instead, Yamazaki assigns fixed colors, either red or blue, which correspond to positive and negative contraction velocities.

The Applicants respectfully submit that Yamazaki does not describe, teach or suggest the following:

- "a processor responsive to... a distribution of said set of parameter signals and a mapping algorithm **to generate a set of color characteristic signals** representative of said values of said movement parameter," as recited in claim 1;
- "generating a set of color characteristic signals representative of said values of said movement parameter **in response to a distribution of said set of parameter signals and a mapping algorithm**," as recited in claim 11;
- "wherein the mapping algorithm comprises a mapping function formed by generating a cumulative total of a frequency of occurrence of said values of the movement parameter, and normalizing the cumulative total to a color map," as recited in claim 1;
- "wherein the mapping algorithm comprises generating a cumulative total of a frequency of occurrence of said values of the movement parameter, and normalizing the cumulative total to a color map," as recited in claim 11;
- "wherein said mapping function is used by said processor as a non-linear transfer function between said values of said movement parameter and said set of color characteristic signals," as recited in claim 1; or
- "using a mapping function of the mapping algorithm as a non-linear transfer function between said values of said movement parameter and said set of color characteristic signals," as recited in claim 11.

B. The Proposed Combination Of Yamazaki And Washburn Does Not Teach Or Suggest Using A Mapping Function As A Non-Linear Transfer Function

The Office Action states that "the newly added language" (namely, wherein said mapping algorithm comprises a mapping function formed by generating a cumulative total of frequency of occurrence of said values of said movement parameter, and normalizing

the cumulative total to a color map) "requires an adaptive color mapping step, which Yamazaki does not teach." *See* July 20, 2006 Office Action at page 3. In order to overcome this deficiency, the Office Action cites Washburn.

Washburn describes color coding of color flow data relating to fluid, such as blood. An Auto Color Map Threshold/Compression Algorithm allows the stored color map threshold to be reset for better detection of low velocity or low power flow and allows the map to be re-mapped or compressed over the range of color flow data actually present. *See* Washburn at column 8, lines 25-54. Washburn discloses two algorithms: one for velocity mode and one for PDI mode. For the velocity mode, N frames of color flow data are collected from cine memory 28C and formed into a composite histogram as shown in Figure 8 of Washburn. The N frames are required to account for flow pulsatility. Then, the fixed map threshold is received by the algorithm from memory at a terminal 31and is adjusted, if necessary, and the color map is re-created to apply more colors of the map across the full range of data in the composite histogram **in a linear manner**. As Figure 8 shows, the positive velocity data in the composite histogram does not cover the full range of 0 to 127, but instead covers some smaller range in-between. The algorithm calculates the statistics of the histogram data and sets the new map threshold to be x standard deviations below the mean. The value of x is determined per application to maximize low velocity flow detection while minimizing low velocity artifacts such as residual wall or tissue motion. In the example of Figure 8 of Washburn, the velocity color map is re-created (effectively linearly compressed) to apply more of its colors across the range of data in the composite histogram, taking into account the map threshold as a reference end point.

Neither Yamazaki, nor Washburn, however, describe, teach or suggest "wherein said mapping function is used by said processor as a non-linear transfer function between said values of said movement parameter and said set of color characteristic signals," as recited in claim 1, as amended, or "using a mapping function of the mapping algorithm as a non-linear transfer function between said values of said movement parameter and said set of color characteristic signals," as recited in claim 11, as amended. Thus, for at least these reasons, the Applicants respectfully submit that claims 1-22 should be in condition for allowance.

C. Amendments During Prosecution

The Applicants have previously discussed the claims with the Examiner. *See, e.g.,* December 13, 2005 Advisory Action. In particular, the Advisory Action states:

> In the third paragraph, where the processor is claimed, only the first two processes are performed in response to input (thus adaptive), while the coloring step does not need to be adaptive. The reason for this contention is that the first two statements begin with the phrase "responsive to", while the final process (the mapping algorithm) does not include this phrase. As discussed in the examiner initiated interview (on 12/2/05) this can be overcome by making it clear that the mapping algorithm is also "responsive to" the input.

See id. at page 2. In response to the interview and the Advisory Action, the Applicants did, in fact, amend the claims to "make it clear that the mapping algorithm is also 'responsive to' the input." *See* December 27, 2005 Submission Under 37 C.F.R. 1.114 at pages 2 and 4.

The March 21, 2006 Office Action, however, states "After further consideration of the art, the examiner still feels claim 1 is not claiming an adaptive color mapping step. . . . The Examiner suggests that the applicant focus more on how the adaptive algorithm

works, as this is most likely where the allowable material lies." *See* March 21, 2006 Office Action at page 5. In response to this suggestion, the Applicants amended the claims to recite that the "mapping algorithm comprises a mapping function formed by generating a cumulative total of a frequency of occurrence of said values of said movement parameter, and normalizing the cumulative total to a color map."

The current Office Action, however, states that "it is not the concept of adaptive color mapping (or which colors are used) that the applicant should focus on, but rather the algorithm used to create the adaptive color map." *See* July 20, 2006 Office Action at page 6. In response to this latest suggestion, the Applicants have "focused on the algorithm used to create the adaptive color map," and have amended the claims as set forth above. The Applicants respectfully submit that the claims should be in condition for allowance for at least the reasons discussed above.

As noted above, the prosecution history of the present application indicates that the Examiner believes that at least the specification of the present application discloses allowable subject matter. If the claim rejections are maintained, **the Applicants respectfully request a suggestion for an amendment, as the MPEP encourages**. MPEP at § 2173.02 ("Examiners are encouraged to suggest claim language to applicants to improve the clarity or precision of the language used, but should not reject claims or insist on their own preferences if other modes of expression selected by applicants satisfy the statutory requirement.").

II. Claims 21 And 22 Should Be In Condition For Allowance

The Applicants next turn to the rejection of claims 21 and 22 as being unpatentable over Yamazaki in view of Washburn and Pesque. The Applicants

respectfully submit that these claims should be in condition for allowance for at least the reasons discussed above.

III. Conclusion

In light of the above, the Applicants request reconsideration of the rejection of the pending claims and look forward to working with the Examiner to resolve any remaining issues in the application. If the Examiner has any questions or the Applicants can be of any assistance, the Examiner is invited to contact the Applicants. The Commissioner is authorized to charge any necessary fees or credit any overpayment to Deposit Account 07-0845.

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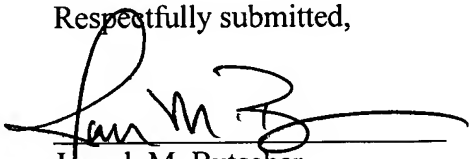
Date: July 31, 2006

Respectfully submitted,



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